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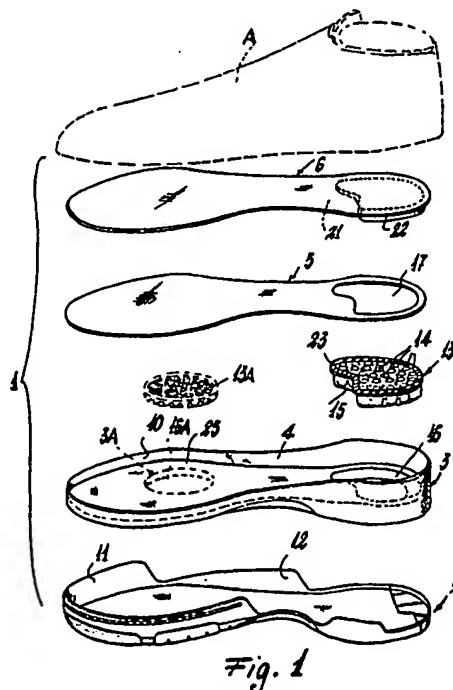
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(54) Sports shoe incorporating an elastic insert in the heel.

(57) A sports shoe having a vamp (A) and a lower support part (1) which includes a sole (2), and a wedge (3) arranged on said sole, a mounting insole (5) and an additional insole (6) which is in contact with the user's foot. The shoe includes, associated with the lower support part (1), an insert (13) comprising elements (14) which are elastically deformable under pressure and which are enclosed in an airtight casing (15) advantageously of a plastic material, the insert (13) being arranged in a seat (16, 17) provided in the wedge (3) and in the mounting insole (5) in a position corresponding with the heel of the foot. A further insert (13A) may be provided at a different location of the shoe.



This invention relates to a sports shoe consisting of a vamp and a lower support part comprising a sole, and a wedge arranged on said sole and housing, mutually superposed, a mounting insole and a further insole which is in contact with the user's or athlete's foot during use of the shoe.

For some years there has been a requirement for sports shoes during use to be able to return to the user, in the form of a thrust force, a part of the energy which has been transferred to the ground by the movement of the user, so as to facilitate lifting of the foot and thus make this movement easier to accomplish.

A particular requirement is for sports shoes of this type which:

(a) provide practically total damping of the impact derived from the leap which the user and especially the athlete executes during running, thus protecting his osseous and joint structure;

(b) optimize the position of the user's foot as he bears down on it, thus preventing the osseous structure from undergoing any type of deformation; and

(c) corrects the pronation and supination defects of each user.

There are already various known constructions which attempt to satisfy the aforesaid requirements. One of these, for example, comprises an air cushion positioned in the lower support part of the shoe and of dimensions substantially equal to those of the wedge, i.e. an air cushion located along the entire length of the foot. Another construction comprises an insole provided over its entire lower surface with elements projecting towards the wedge, and yet another construction comprises a honeycomb structure arranged to correspond with the heel of the shoe.

All of these constructions have drawbacks which cannot be ignored. For example, the manufacture of a shoe provided with an air cushion is expensive and in any event does not completely satisfy the aforesaid requirements. In this respect, although an air cushion positioned along the entire length of the foot on the one hand results in a very comfortable shoe, it does not, on the other hand, exert the required thrust on the foot. In addition, the air cushion can not confer a good multidirectional stability and flexibility to the shoe.

Although the other shoe constructions mentioned above provide good comfort to the user's foot, they do not properly attain the stated objects. Other shoe constructions are known which on one hand at least partly satisfy the aforesaid requirements, but on the other hand are of such high cost as to put them beyond the means of that large mass of purely amateur users who indulge in jogging.

An object of the present invention is therefore

to provide a sports shoe which satisfies the aforesaid requirements and which more particularly enables a large part of the thrust transmitted by the user to the ground to be retransmitted to the user's foot. A further object is to provide a sports shoe which does not penalize the thrust action exerted by the user on the front part of the shoe, and which has multidirectional stability and flexibility.

These and further objects which will be apparent to one of ordinary skill in the art are attained by a sports shoe of the aforesaid type, characterized by including, associated with the lower support part, at least an insert comprising elements which are elastically deformable under pressure and are enclosed in an airtight casing advantageously of plastic material, said insert being arranged in a seat between a wedge and a mounting insole, in a position corresponding with the heel of the foot.

The seat is preferably provided in the wedge and is closed by the superimposed mounting insole.

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

Figure 1 is an exploded view of the lower support part of a sports shoe according to the invention;

Figure 2 is a bottom view of the sports shoe according to the invention;

Figure 3 is a sectional view taken along line III-III of Figure 2; and

Figure 4 is a sectional view of an alternate embodiment.

With reference to the figures, the sports shoe of the invention comprises a vamp A and a lower support part 1 comprising a sole 2, for example of synthetic rubber, to which a wedge 3, for example of thermoplastic polyurethane, is fixed in known manner. The wedge comprises a recess 4, bounded by a raised edge 10, carrying a mounting insole 5, for example of cork, on which there is positioned a further insole 6, for example of fabric (not shown in Figure 3). The sole 2, constructed advantageously of rubber, comprises the usual notches 7 and incisions or recessed portions 8 in its lower surface. It also comprises a front raised edge 11, and a lateral edge 12 which extends along the entire remaining perimeter of the sole.

According to the invention, in the lower part of the shoe there is arranged an insert 13 comprising elastically deformable elements 14 made of thermoplastic material enclosed in an air-tight casing 15 constructed of plastic material such as polyurethane or a similar material. In casing 15 there is present air that has a pressure less than or equal

to the atmospheric pressure. In this example, the insert 13 is positioned in seats 16 and 17 provided in the wedge 3 and in the insole 5 respectively, said seats being superposed.

Alternatively, seat 17 can be omitted with insert 13 located only in seat 16 of wedge 3, so that the insole 5 is superimposed and covers seat 16.

More specifically, the elements 14 of the insert 13 are formed by molding any synthetic high-elasticity material and are substantially barrel-shaped, i.e., they are tapered at their opposing free ends 18 and 19 and have their major cross-section substantially in the central region 20 in which said elements are joined together by integral bridging portion 20A. Due to manufacturing requirements of insert 13, free ends 18, 19 of barrel-shaped elements 14 are fastened to casing 15. This is actually the preferred embodiment of insert 13, wherein in a first phase, elements 14 are obtained by means of molding; subsequently they are encased inside thermo-soldering plastic sheets which constitute casing 15; the elements 14 are encased by sheets when they are at a relatively high temperature so that a welding of free ends 18, 19 of elements 14 with the sheets occurs. The connection between casing 15 and the barrel-shaped elements has the advantage of anchoring said elements inside said casing, thereby preventing the casing and barrel-shaped elements from moving during use of the shoe according to the invention and so contributing together with the mutual connection of the barrel-shaped elements 14 to the good multidirectional stability and flexibility of the resulting shoe. This affords a greater stability for insert 13 within the shoe, and permits better performance of the function for which it is intended, which functions will be further defined below.

The shape of the elements 14, as shown and described by way of example, allows considerable absorption of the stresses caused by the user's foot as he moves, and at the same time allows a large part of the absorbed energy to be retransmitted rapidly but gradually to the foot.

In order to secure the insert 13 within the seats 16 and 17, the insole 6 comprises on that face 21, facing the insole 5, a projection 22 of shape corresponding to said seats and arranged to cooperate with them and with the insert 13. In the alternative embodiment recited above, the projection 22 can be omitted.

The casing 15 of insert 13 comprises a flange 23 which, when the insert 13 has been positioned in the lower part 1 of the shoe, rests on a step 24 provided between the insole 5 and inner surface 25 of the wedge 3. In the alternative, where the hole or seat 17 is omitted, the flange 23 (very thin) rests on the contour of the wedge seat 16.

Finally, the sole comprises a reinforcement ele-

ment 28 positioned below the insert 13 or in other positions of the sole where others inserts may be located, said reinforcement element 28 formed, for example, of plastic material e.g. of natural or synthetic rubber is advantageously somewhat transparent. Element 28 may or may not be tinted. Reinforcing element 28 is of a wear and abrasion resistant material and is preferably located in the heel portion and in the metatarsal portion of the sole.

During the use of a shoe according to the invention, each time the user presses the lower part 1 of the shoe with his foot, the insert 13 is pressed towards the sole 2. Specifically, the pressing action exerted by the foot depresses the elements 14 which deform and increases the pressure within the airtight casing 15 which is constricted by the surrounding wall portion of its seat. When the user's heel ceases its pressing action, the elements 14 return to their initial configuration, so as to transmit a large part of the energy acquired during the pressing action to the user's foot, which therefore receives a gradual thrust as his heel (or other part of the foot, e.g. the metatarsal one) separates from the ground. To said thrust, exerted on the user's foot by elements 14, there must be added the thrust exerted by the air which is present inside insert 13, this air being under pressure due to the action by the user's foot. These combined thrusts help transfer to the user's foot part of the energy transmitted by the user to the ground during movement.

Elastic inserts like the one disclosed above can be located in the other regions of the support part 1, in particular in proximity to the frontal region of the sole 2 and wedge 3 and more particularly in the metatarsal zone 3A as shown in dotted lines in Fig. 1, where the seat is referenced by 16A and the insert by 13A, thus allowing the user (particularly an athlete) to obtain increased pickup during acceleration or during changes in the rate of movement.

The insert 13 shown in Fig. 1 and 3 comprises only one layer of elements 14; however, there can be provided an insert 13 having two or more layers of elements 14 superimposed as shown in Fig. 4. In particular, if the above cited insert has two layers of elements 14, a first layer supports the second whose deformable elements rest on the elements positioned below.

This further permits an improvement in the return of part of the energy (passed on by the user to the ground) to the foot of the user. It must be noted that, in the same manner previously described, free ends 18, 19 of barrel-shaped element 14, are fastened to (or soldered on) casing 15, whereas the contact surfaces of the two layers of element 14, if used, would be fastened to (or soldered on) each other. This affords stability for

insert 13, preventing one of the layers from sliding over the other one within casing 15. A shoe constructed in accordance with the invention satisfies the aforesaid requirements and in particular enables most of the energy expended during movement to be retransferred to the foot.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings.

One of these different embodiments of the present invention is shown by dotted line in Fig. 1; this embodiment comprises an additional insert 13A located in seat 16A provided in metatarsal area 3A of wedge 3.

Also, insert 13A can comprise one or more layers of interconnected barrel-shaped elements 14.

It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein; in particular, other than insert 13 positioned in the heel area of wedge 3, the invention can comprise another insert positioned in properly selected areas of said wedge (such as the arch area), said insert(s) being similar to insert 13.

## Claims

1. A sports shoe which comprises: a vamp (A); and a lower support part (1) connected to said vamp (A) and which comprises a sole (2), a wedge (3) arranged on said sole (2) and housing, mutually superposed, a mounting insole (5), an insole (6) for contacting a user's foot, and seat means (16, 17) provided in said wedge (3); and characterized in that at least an insert (13) mounted in said lower support part (1) is provided, said insert (13) including an airtight casing (15) and a plurality of elements (14) which are elastically deformable under pressure and which are enclosed in said airtight casing (15), said insert (13) being positioned in said seat means (16, 17) in a position corresponding with a heel of the foot of a user.

2. A shoe is claimed in claim 1, wherein said elastically deformable elements (14) are of barrel shape, tapering towards opposing free ends (18, 19) thereof and having a major cross-section in a central region (2) thereof.

3. A shoe as claimed in claim 1 or 2, wherein said insert (13) has at least one layer of elastically deformable elements (14) joined together in a central region (20) thereof.

4. A shoe as claimed in Claim 3, wherein a first and second layer of elastically deformable elements (14) are superimposed inside said insert (13) such that elements (14) of said first layer rest on

elements (14) of said second layer.

5. A shoe as claimed in Claim 3, wherein means for fastening free ends of said elements (14) to said casing (15) are provided, said means for fastening comprising a soldering connection of said free ends (18, 19) to said casing (15).

6. A shoe as claimed in Claim 4, wherein said elements (14) of said first and second layer each have free ends (18, 19) connected to said casing (15) and adjacent free ends (18, 19) of said elements (14) are connected by a soldering connection.

7. A shoe as claimed in Claim 1, wherein said insole (6) for contacting the user's foot comprises a face portion (21) facing said mounting insole (5) and a projection (22) of a shape corresponding to the shape of said seat means (17) in which the insert is positioned.

8. A shoe as claimed in claim 1, wherein the sole (2) comprises a reinforcement element (28) of at least partially transparent plastic material.

9. A shoe as claimed in claim 1, characterized by comprising at least one additional insert (13A) located in a different seat (16A) of the wedge (3), said insert including an airtight casing and at least one layer of a plurality of elements which are elastically deformable under pressure and which are enclosed in said airtight casing, said elastically deformable elements being of barrel shape, tapering towards opposing free ends thereof and having a major cross-section in a central region thereof.

10. A shoe as claimed in Claim 9 wherein the additional insert (13A) comprises a casing, means for fastening free ends of elastically deformable elements to said casing, wherein said means for fastening comprises a soldering connection of said free ends to said casing.

11. A shoe as claimed in claim 9 wherein the additional insert (13A) is positioned in the metatarsal foot area of the wedge.

12. A shoe as claimed in claim 9 wherein the additional insert is positioned in the arch foot area of the wedge.

13. A shoe as claimed in claim 9, wherein the sole (2) comprises a reinforcement element (28) of at least partially transparent plastic material located at each additional insert (13A) of the shoe.

14. A sports shoe which comprises: a vamp (A); and a lower support part (1) connected to said vamp (A) and which comprises a sole (2), a wedge (3) arranged on said sole (2) and housing, mutually superposed, a mounting insole (5), an insole (6) for contacting a user's foot, and seat means (16, 17) provided in said wedge (3) characterised by a plurality of inserts (13, 13A) mounted in said lower support part (1), said plurality including an airtight casing (15) and a plurality of elements (14)

which are elastically deformable under pressure and which are enclosed in said airtight casing (15), each insert (13, 13A) being positioned in a different seat of the wedge.

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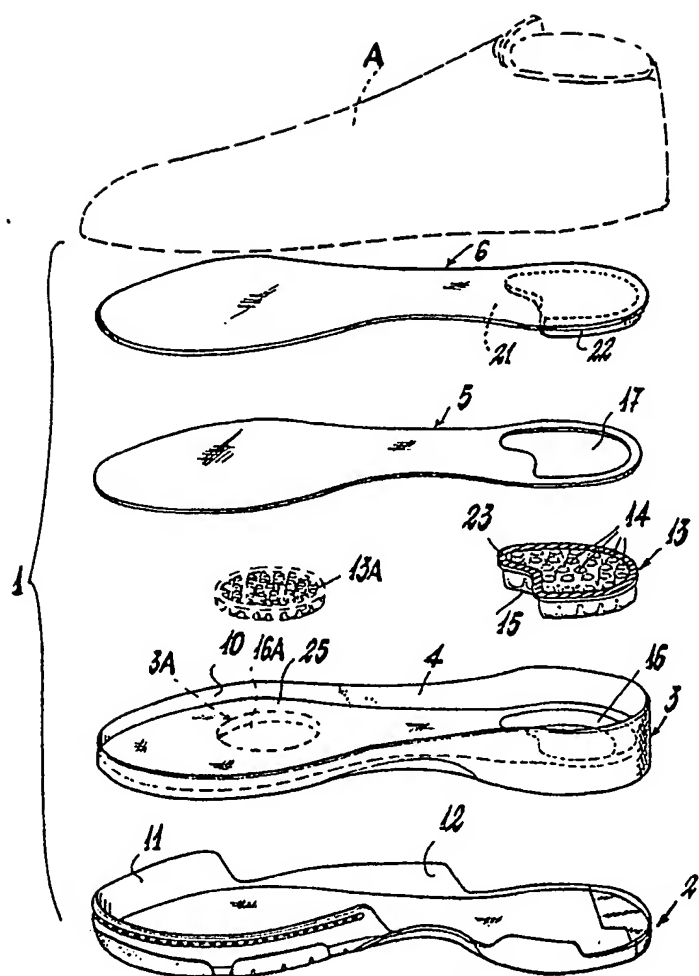


Fig. 1

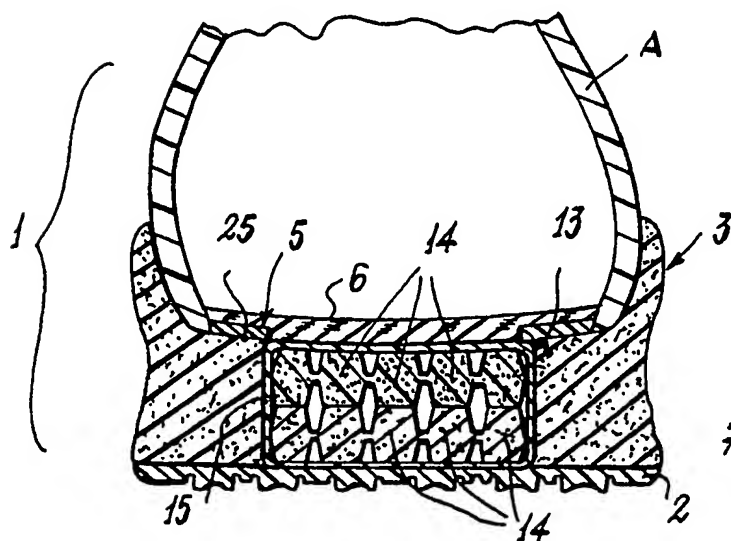


Fig. 4

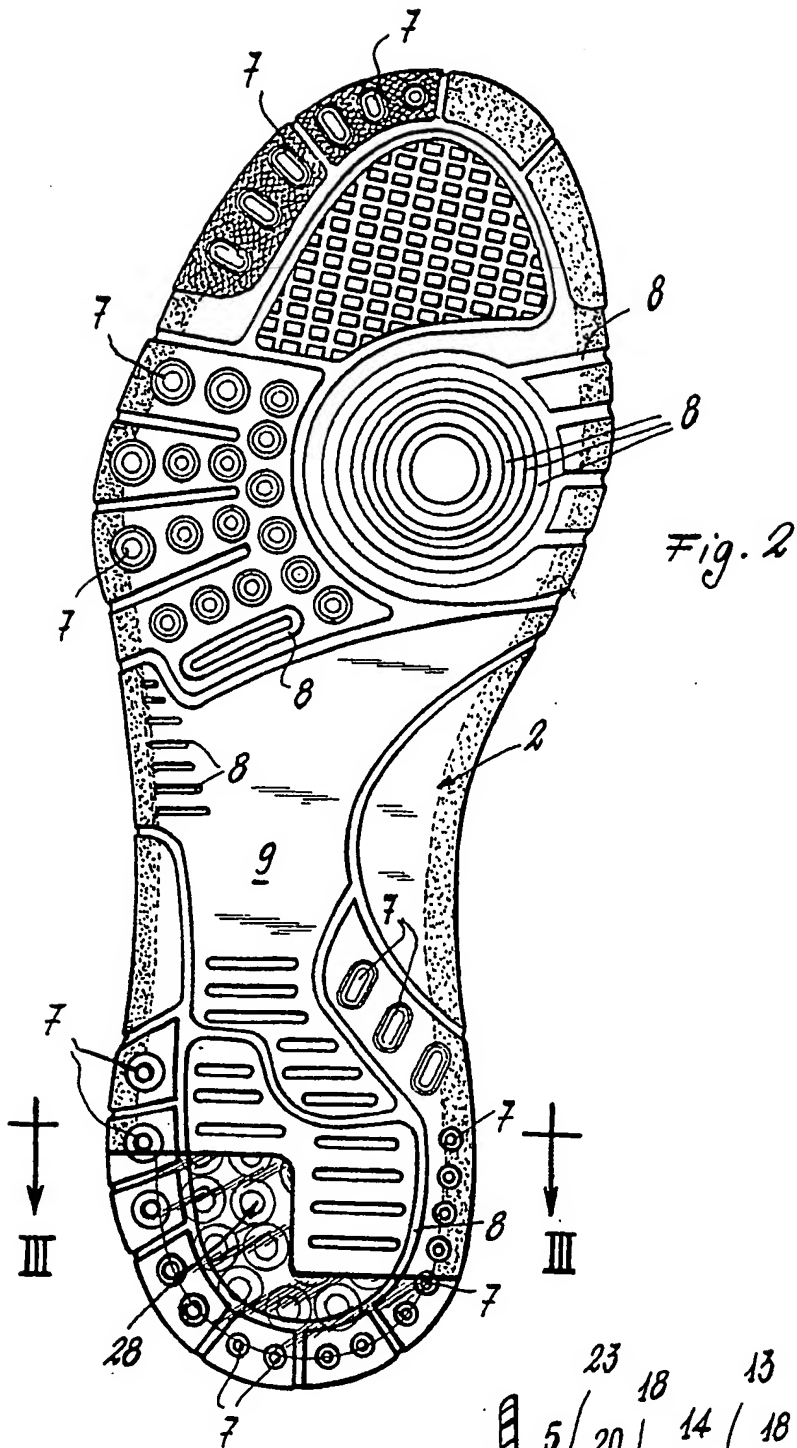
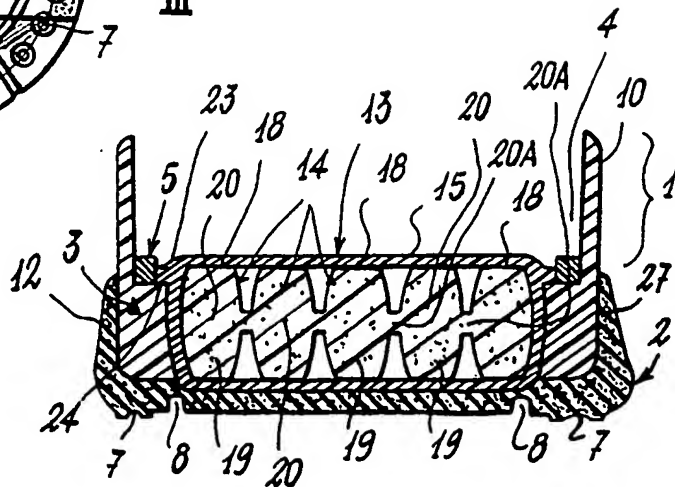


Fig. 3





European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number

EP 90 10 9097

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	DE-A-2 901 084 (METZELER KAUTSCHUK) ---	1,9,11, 12,14	A 43 B 13/20 A 43 B 21/28
A	US-A-4 236 326 (MASANOBU INOHORA) ---	1-3,14	
A	US-A-3 253 355 (L. MENKEN) ---	1,14	
A	GB-A-2 183 446 (A. SIGNORI) ---	1,14	
A	US-A-4 815 221 (J. DIAZ) ---	1	
A	FR-A-2 535 950 (SECOMEX) -----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A 43 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14-06-1990	Examiner DECLERCK J.T.
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			